Jarvis (W. G.)

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By Means of an Electric Motor, Nasal Drills and an Original Spray-Producing Device

WITH ILLUSTRATIVE CASES

BY

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A Novel System of Operating for the Correction of the Deflected Septum[1]

By means of an Electric Motor, Nasal Drills, and an Original Spray-Producing Device.

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By WILLIAM CHAPMAN JARVIS, M.D.,

PROFESSOR OF LARYNGOLOGY AND DISEASES OF THE NOSE AND THROAT IN THE NEW YORK UNIVERSITY MEDICAL COLLEGE, CONSULTING LARYNGOLOGIST TO THE OUTDOOR DEPARTMENT OF BELLEVUE HOSPITAL.

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DESPITE the numerous methods which have been advanced by laryngologists for the correction of malformed or displaced septa, no single procedure or device has evidently been invented which can justly claim the right of universal applicability for the successful treatment of the conditions met with in this deformity. Rather than view this as an indication of inefficiency or irresolution, I would, on the contrary, profiting from the common experience of the past, interpret the formidable array of instruments as a commendable effort to successfully cope with the various contingencies which may be met with in the treatment of the deflected septum. It is even difficult to imagine a single instrument possessing the combined property of cutting with facility and precision the

[1] Presented at the New York Academy of Medicine (Laryngological Section) March 23, 1887.

hardest bone or softest membrane. This, nevertheless, would be required of an instrument designed for the successful treatment of deflected septa, composed, as they may be, of hypertrophied mucous membrane, dense, elastic cartilage, or compact bone.

Several devices have been already brought forward by me for curing the deflected septum, which, judging from their liberal acceptance in print and practice, have more than survived the usual surprise provoked by the presentation of therapeutic novelties. I do not desire this addition to my septum armamentarium, namely, the electric motor and novel system of drilling, to be interpreted as an expression of dissatisfaction with earlier procedures, but rather as an intention to make these operations more effective. Indeed, I rarely if ever complete an operation upon the septum by means of the electric drill alone, for the reason that my delicate punches, cartilage-scissors, and bone-forceps afford valuable assistance for the removal of adherent tissue débris, in the form of shreds of mucous membrane or cartilaginous and osseous asperities.

A sufficient experience with the common treadle surgical engine, and particularly with an improved form of this apparatus, invented and used by me during an extended period for intra-nasal operations, has convinced me that the natural dread occasioned by the sight of the cumbersome and rapidly revolving noisy machinery constitutes a menace to the usefulness of the nasal drill. This sometimes serious objection, though mostly of a psychical nature, is effectively overcome by the employment of the electric motor, concealed in its narrow shell suspended in mid-air, but few patients possessing an idea of the great power conveyed by the quiet, mysterious movements of this apparently insignificant mechanism.

My earliest results with the electric motor, in operations upon the septum, were obtained by means of a very ingenious dental instrument, devised by the late Dr. Robert Arthur, of Baltimore, and for the use of which I am indebted to my friend Dr. George Arthur, U. S. N.

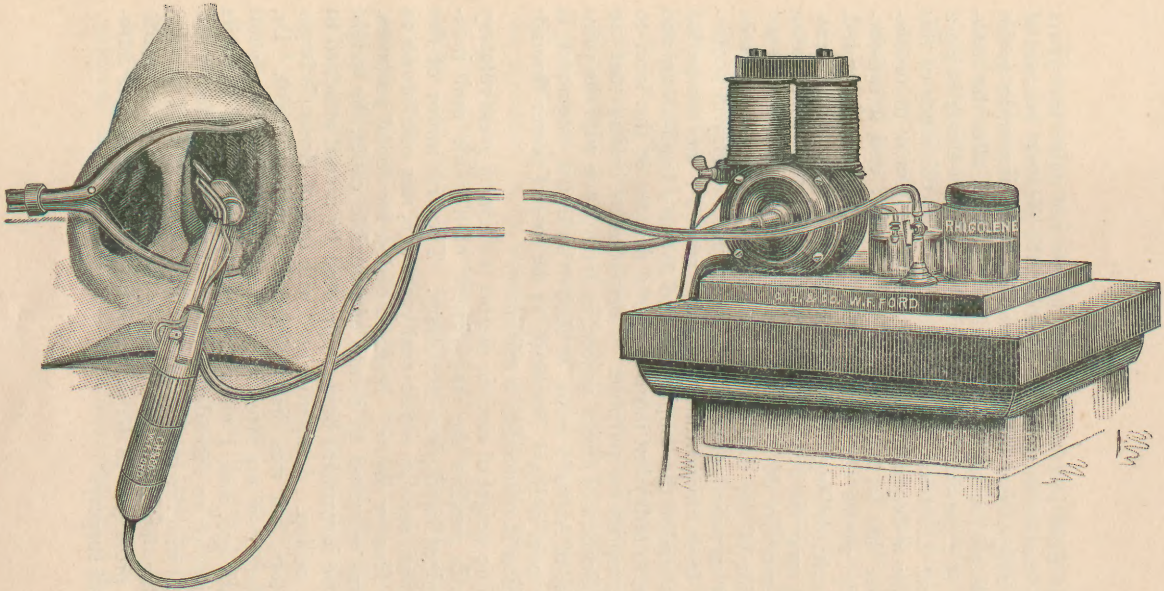

Fig. 1.

This little instrument, used by me not quite two years ago, was constructed to combine the greatest amount of working power with the smallest bulk, inasmuch as the drills and magnet were held in the hand, after the manner ot a pen-handle, the mandril and drill-chuck being a direct extension of the armature. The efficiency of this motor is dependent upon the great number of its revolutions, that is, the acquired momentum, and it satisfactorily serves the purpose for which it was intended, namely, drilling the teeth. Although I succeeded in cutting away the dense structures entering into the formation of extensive deviations of the septum, the frequent retardation of the drill's revolutions when unusual pressure was exercised, gave rise to inconvenient delay in acquiring fresh momentum. For this reason I was compelled to abandon the employment of Arthur's hand-motor and turn to bulky but more powerful devices of the kind to accomplish my purpose. I nevertheless believe that the application of direct power, in accordance with the principle of Arthur's motor or Robert's electric osteotome, is the most rational, inasmuch as the loss of power through friction is reduced to a minimum.

The weight of electric motors possessing great rotatory inertia renders the employment of a cable and independent hand-piece necessary. The first motor of this pattern, seen by me several years ago, was one known as the Hussey motor. Being intended for dental purposes, it was operated by means of a flexible cable, the weight of the instrument being supported by a cord attached to the ceiling. I experimented with one of Hussey's larger motors, but was disappointed in the instrument. Dr. Seiler drew my attention to the Griscom motor several years ago, and I embraced an opportunity to study its action for an extended period, but was not perfectly satisfied with the instrument. To Dr. Carl Seiler, I believe, is due the credit of first calling the attention of the medical profession to the utility of the electric motor in intranasal surgery.

The experience just described led me to discover and utilize the powerful but compact C and C electric motor. Inasmuch as this instrument has proved in my hands the desideratum sought for, I shall give it exclusive attention, only referring to other motors for purposes of comparison. This electric motor is shown in Fig. 1, together with the accessory operating appliances. The axle-shaft can be discerned projecting from the centre of the motor-box. By simply unscrewing the face-place the component parts of the motor can be readily reached and examined. The armature, of the ring type, is wound continuously, wire of trapezoidal section being used. The commutator brushes are so arranged that no injury can arise from reversing the motion of the armature. The commutator segments, seventeen in number, are placed in a circular manner, being separated by an interval of only one-sixteenth of an inch. This close arrangement of the segments secures uninterrupted and great power without sacrificing speed. Hence there is absolutely no dead-point, a prevalent objection with electric motors, and the common annoyance of laboriously adjusting the armature at intervals during an operation is, by this device, relegated to the inconveniences of the past.

The counter-electromotive force generated by the motor running at 1,800 turns a minute, with an 18-ampère current in the field, is 5 volts. The revolutions can be carried as high as 2,000 to the minute. Its extreme capacity equals $\frac{1}{8}$-horse power. The dimensions of the instrument are $7\frac{1}{2} \times 5 \times 3$ inches, and weight 12 pounds.

A single quantity-cell supplies sufficient electromotive force for any ordinary nasal operation; two of these cells furnish an excess of power, even in operations including the densest portion of the vomer. To facilitate the attachment of the flexible shaft, I have had constructed a metallic sleeve which slips over the journal-box of the motor. Within this sleeve is an angular rod, soldered to the flexible cable, which slips in a groove

cut into the centre of the axle of the armature. The free movement of this rod within the groove favors the flexion of the cable, and permits the shafting to be quickly attached or withdrawn. The electric motor can be used either attached to a convenient table or suspended by wires from the ceiling.

The wires running from the battery are interrupted before reaching the motor and arranged upon a foot-board. The convenient cut-off thus formed is simply composed of a sheet of spring brass, which the pressure of the operator's foot brings in contact with a button, through which the electric current is conducted to the motor. This device, I have been recently informed, has been likewise invented by Mr. Griscom. Although it is possible by this arrangement to instantly cut off the current, if desired, the sudden interruption of the electric flow is not really required, inasmuch as the easy withdrawal of the small nasal drills, even while running at full speed, is a very simple procedure.

After experimenting with several kinds of batteries, I have finally settled upon a modification of Bunsen's cells, a plunge and a gravity battery, as the most convenient.

My improved plunge battery is so arranged that a succession of cells can be automatically thrown into the circuit by simply raising the lid of the box which supports the elements, sliding it along a rod, which serves as a hinge, and allowing the cover to descend, when the plates dip into the fluid, bringing themselves by their submergence into connection with the preceding cell. By reversing this procedure the plates are removed from the cells, being finally received into drip-cups, where they remain until used again.

The automatic connection of several cells by this arrangement obviously facilitates prompt action, and saves time, trouble, and complications likely to occur in the adjustment of key-boards and switches. If desired this battery can, by a slight change in the connections, be converted from a series of cells into one giving the effects

of a single cell, and therefore appropriate for running low-tension motors. By another arrangement I am enabled to utilize the current from a stationary gravity galvano-cautery battery.

The employment of small nasal drills, already referred to, I desire to lay particular stress upon, as constituting a desirable digression from the routine course heretofore pursued, of resorting to large and cumbersome devices of the kind in operations upon the nose. To facilitate the practice of keeping the parts operated upon constantly in view, the dimensions of the drill must necessarily be made small. When large drills are employed, the ingenious shielded multiple knife of Dr. Goodwillie, for example, so effectively employed by him, a view of the field of operation is rendered difficult or impossible, and the operator is compelled to rely upon his acquired *tactus eruditus*, to the exclusion of his sense of sight.

The long practice required to attain the necessary tactile proficiency to operate with precision, though blind to the exact behavior of the drill, it seems to me, must seriously interfere with the extensive adoption of large nasal drills in general practice. Furthermore, surgeons will naturally hesitate to permit keen-edged cutting instruments to rapidly revolve out of sight in close contiguity to the brain, beneath the frail plate of the ethmoid. The extreme narrowness of the superior meatus makes it impossible to satisfactorily employ shielded drills in this region.

Although keeping for convenience a number of nasal drills of different shapes and dimensions, I shall largely confine myself to the description of two of these, namely, my rasp drill and nasal plane. The rasp drill (Fig. 3) is virtually a hollow file, the teeth of which have been made to project, in the form of diminutive knife-points, for the distance of one-sixteenth of an inch above the circumference of the tube. These pyramidal teeth are cut at intervals of one-eighth of an inch along the circumference of the steel tube, and their relation to each other is so ad-

justed that a simple rotation of the instrument produces an incision resembling that made by the cut of a continuous knife-edge.

A vent-hole, cut at the distance of an inch from the tip of the drill, permits the detritus to escape and thus prevents clogging of the steel teeth, an objection met with in many cutting devices of the kind, and at the same time frees the parts from the tissue débris which is apt

FIG. 2.

to accumulate and obscure the field of operation. The extremity of the drill may be capped by a crown-knife, to prevent the eroded tissues from escaping into the nostril, and at the same time furnish an effective direct drill. These little tubular drills are capable of cutting through the densest cartilaginous or osseous structures found in the nostril, with great rapidity and perfect precision.

FIG. 3.

Several forms of these nasal drills are constructed, the difference depending upon the length of the teeth.[1]

In the tubular scissors or nasal plane (Fig. 2) I have utilized a cutting device which has been already employed in other parts of the body in various forms and for different purposes. It consists of a small cylinder within which rotates a delicate tube, the end of which can

[1] An ingenious application of the trephine, shown to me by Dr. H. Curtis, and employed by him in conjunction with an electric motor, deserves especial mention. The removal, by this small drill, of the mucous membrane over the deflected septum I do not deem an objection to its use in cases where the vomer is the seat of the deflection, since the preservation of the pituitary membrane to facilitate rapid healing at this remote point, can hardly compensate for the time and labor required to attain the object. I shall therefore promptly add this useful instrument to my operative armamentarium.

be discerned through the fenestra as shown in the figure. The inner tube, it will be observed, is set with a row of fine teeth. These teeth, if deemed desirable, can be dispensed with.

A useful feature of these drills will be recognized in the property they possess of removing bone and cartilage of the deflected septum without injury to the overlying mucous membrane. It is obvious that the preservation of the pituitary membrane in its entirety and integrity affords protection to the wound, and hastens the restoration of the injured tissues to their proper functions. It will often be found convenient to separate the mucous membrane and temporarily secure it to the roof of the nostril by means of cotton pledgets before cutting away the subjacent bone or cartilage.

The hand-piece employed by me (Fig. 1) as a drill-holder, invented by Mr. Weber, has the great advantage of clutching the drills after the manner of a powerful chuck. A right-angled adjustable gearing device can be made by means of a sleeve to slip over the top of the hand-piece. The right angle will be found useful for keeping the drill's point constantly in view while operating in the deeper portions of the nasal cavity. It is larger and more powerfully constructed than those usually employed by dentists. A useful addition to the hand-piece will be observed in the illustration (Fig. 1) in the shape of an adjustable spray-producing device, invented by me to facilitate the practice of keeping the drill in sight. It accomplishes this result by showering the wounded tissues with cleansing fluids, or by means of the air-douche alone, while the drill is in full action. The force of the compressed air, charged with moisture, impinges upon the cut and bleeding tissues, whipping the blood-clots far beyond the field of operation. In obtaining this result I have found it necessary to branch off from the usual methods adopted for projecting sprays, on account of the obstruction that would be ordered by the fluid receptacle. The change consists in an extraor-

dinary lengthening of the fluid conduit. This was accomplished by means of a fine rubber tubing, two or three feet in length, beginning in the spray tube and ending in the fluid receptacle. The air and fluid tubes are joined together for almost their entire length. An adjustable cut-off slipping over the head of the handpiece enables the operator to regulate the spray at pleasure. The spray-tube proper is attached to a ring which revolves around the drum of the right angle. This arrangement renders it possible to direct the spray in any desired location about the drill. I employ the same device to produce and keep up rhigolene or cocaine anæsthesia.

I shall conclude with a brief description of two illustrative cases, selected from a number of the kind, as good examples of the results obtained by the employment of the electric motor and drills. The first case, a broker's clerk, aged twenty, referred to me by a patient upon whom I had successfully operated, consulted me in October, 1885. The patient proved to be an habitual mouth-breather, and did not remember ever having breathed freely through the nostrils. He was often deprived of needed rest by being awakened during the night with a parched throat. The accumulation of thickened mucus in his nostrils was a source of constant annoyance. He also complained of tinnitus aurium.

Examination.—An inspection of the anterior nares showed pronounced distortion of the septum in the shape of an extensive general deflection of the triangular cartilage to the left, also a localized deviation of the columna to the right, as shown in Fig. 4, taken from a life-sketch. The displaced cartilage pressed firmly against the inferior turbinated tissues in the left nostril, producing complete occlusion on this side.

The right nostril, though only partially obstructed by a localized deviation of the septum, associated with an inferior turbinated hypertrophy, possessed very little respiratory value. Without entering into the details recorded in my case-book, I will simply state that the

careful employment of the electric motor and drills, in conjunction with my stellate punch, cartilage, and bone-trimming forceps, resulted in the satisfactory correction of the deformity, the complete restoration of nasal respiration, and normal nasal drainage, and the consequent disappearance of all the annoying symptoms.

Fig. 5, drawn from a life-sketch, taken five months

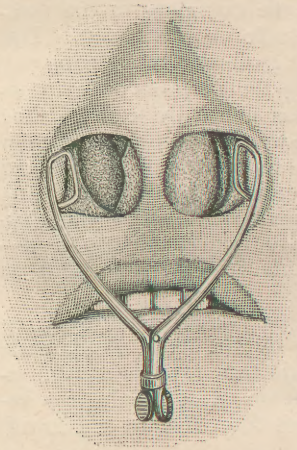

FIG. 4.

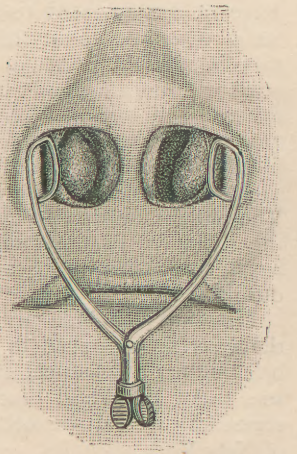

FIG. 5.

subsequent to the operation, shows the appearance of the parts after complete healing had occurred.

The next case I shall present is that of a druggist, aged twenty-seven, who consulted me February 17, 1887, in search of relief from a difficulty in breathing. The left nostril was permanently stenosed, and the right one, though partially free, would become periodically obstructed, and was a source of constant annoyance.

Examination.—Anterior rhinoscopic inspection demonstrated the existence of an extensive osseo-cartilagi-

nous deflection of the septum to the left, extending as far back as the middle of the vomer. The patient did not manifest the slightest dread in submitting to an operation in which the electric drills were employed. The osseous and cartilaginous tissue was first cut away with the rasp drill, and subsequently smoothed down by means of the revolving nasal plane. Forty minutes were consumed in cutting a large opening from the anterior free edge of the deviated tissue, the columna, to the post-nasal opening, about the middle of the vomer. This time included intervals of rest required for spraying the parts with cocaine and noting the progress of the operation. The loss of blood was unusually scanty. One month after the operation the wounded septum had completely healed, leaving a large interspace between it and the lateral nasal wall for the entire length of the nostril. The patient stated that the great cause of his suffering, the difficulty in breathing, had entirely disappeared—nasal respiration being as perfect in the night-time as during the day.

I cannot conclude my paper without acknowledging the courtesy extended to me by Mr. W. F. Ford, while bringing my mechanical experiments to a successful issue, and I might add that any or all of the devices described by me can be obtained from Hazard & Hazard, of New York.